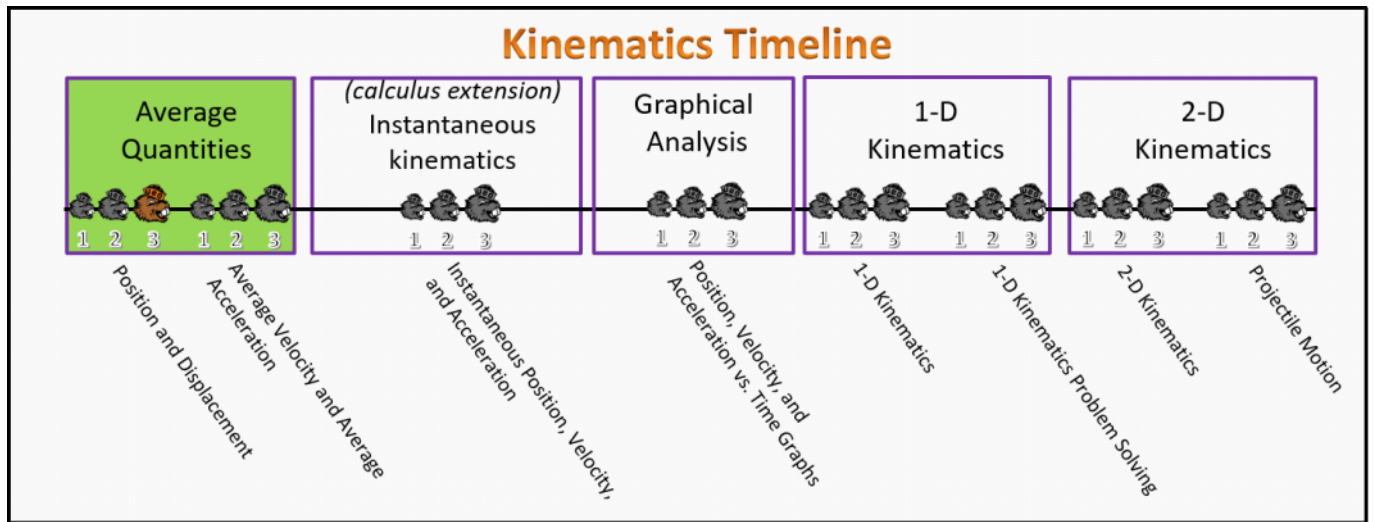


# Average Quantities Foundation Stage (AQ.L1.3)

## Post-Lecture 1 Position and Displacement



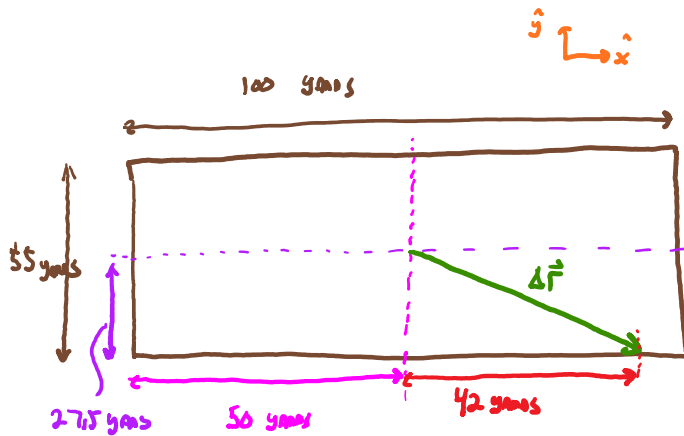
### Questions

#### AQ.L1.3-01

**Description:** Magnitude of displacement of a punted football

**Learning Objectives:** [3,4]

**Problem Statement:** A kicker punts a football from the very center of the field to the sideline 42 yards downfield. What is the magnitude of the net displacement of the ball in yards? (A football field is 55 yards wide.) Note that the unit expression for yards is yd.



$$\Delta \vec{r} = \langle 42, -27.5 \rangle \text{ yards}$$

$$|\Delta \vec{r}| = \sqrt{42^2 + 27.5^2} \text{ yards}$$

$$\approx 50.2021 \text{ yards}$$

$$|\Delta \vec{r}| \approx 50.2 \text{ yards}$$

**AQ.L1.3-02**

**Description:** Finding the displacement from an initial and final position.

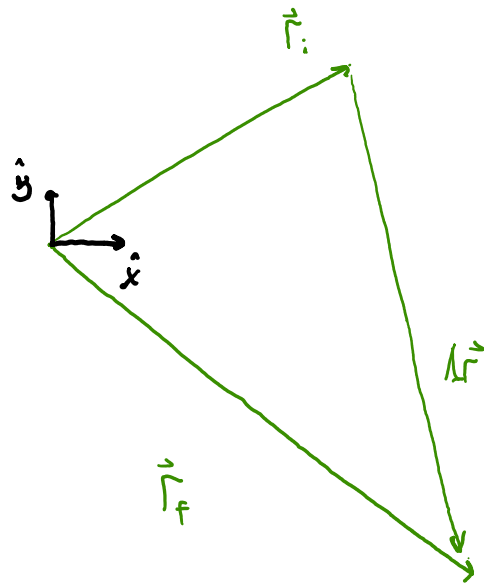
**Learning Objectives:** [3,18,28]

**Problem Statement:** An Unidentified Flying Object (UFO) is located at a position  $\langle 400, 350 \rangle$  m. After a few minutes it has moved to a location  $\langle 650, -800 \rangle$  m. What is the displacement of the UFO?

- (1)  $\langle 250, 450 \rangle$  m
- (2)  $\langle 1200, 300 \rangle$  m
- (3)  $\langle 1050, -450 \rangle$  m
- (4)  $\langle 250, -1150 \rangle$  m
- (5)  $\langle 150, -250 \rangle$  m

$$\begin{aligned} \Delta \vec{r} &= \vec{r}_f - \vec{r}_i \\ &= \langle 650, -800 \rangle - \langle 400, 350 \rangle \end{aligned}$$

$$\Delta \vec{r} = \langle 250, -1150 \rangle \text{ m}$$



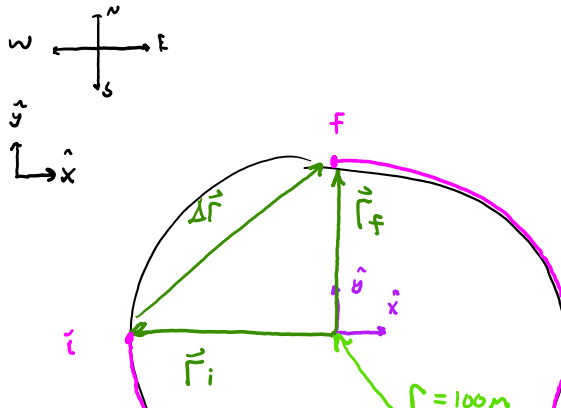
**AQ.L1.3-03**

**Description:** Finding the magnitude of displacement on a circle.

**Learning Objectives:** [2,3,4,28]

**Problem Statement:** A park has a circular 100-m-radius pond. Benny starts at the westernmost point, then waddles counterclockwise around the pond until he is at the northernmost point. What is the magnitude of Benny's change in position?

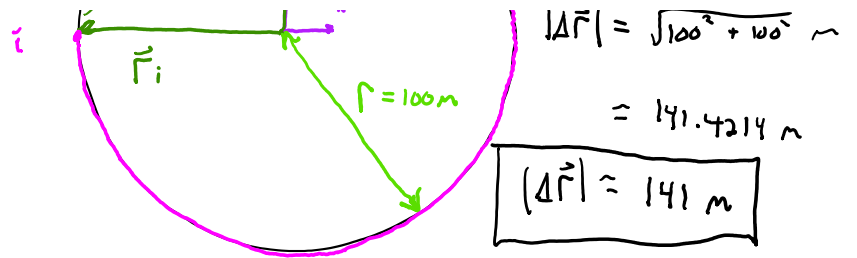
- (1) 100 m
- (2) 200 m
- (3) 141 m
- (4)  $\langle 100, 100 \rangle$  m
- (5)  $\langle -100, 100 \rangle$  m



$$\begin{aligned} \Delta \vec{r} &= \vec{r}_f - \vec{r}_i \\ &= \langle 0, 100 \rangle - \langle -100, 0 \rangle \end{aligned}$$

$$\Delta \vec{r} = \langle 100, 100 \rangle \text{ m}$$

$$|\Delta \vec{r}| = \sqrt{100^2 + 100^2} \text{ m}$$



**AQ.L1.3-04**

**Description:** Finding the direction of displacement on a circle.

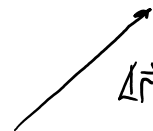
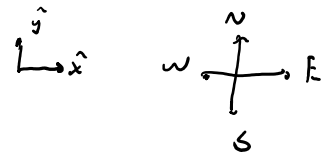
**Learning Objectives:** [3,28]

**Problem Statement:** A park has a circular 100-m-radius pond. Benny starts at the westernmost point, then waddles counterclockwise around the pond until he is at the northernmost point. What is the direction of Benny's change in position?

- (1) North
- (2) Southwest
- (3) Southeast
- ④ Northeast
- (5) Northwest

From AQ.L1.3-03 ...

...  $\Delta \vec{r} = \langle 100, 100 \rangle \text{ m}$



**AQ.L1.3-05**

**Description:** Finding the initial position from a final position and a displacement.

**Learning Objectives:** [3,18,28]

**Problem Statement:** An Unidentified Flying Object (UFO) is located at a position  $\langle 400, 350 \rangle \text{ m}$ . It is known that over the past few

minutes it had moved through a displacement  $\langle 650, -800 \rangle$  m. What was the initial position of the UFO before it went through the displacement?

- (1)  $\langle 250, 450 \rangle$  m
- (2)  $\langle 1050, 300 \rangle$  m
- (3)  $\langle 1050, -450 \rangle$  m
- (4)  $\langle 250, -1150 \rangle$  m
- (5)  $\langle -250, 1150 \rangle$  m

$$\Delta \vec{r} = \vec{r}_f - \vec{r}_i$$

$$\Delta \vec{r} + \vec{r}_i = \vec{r}_f$$

$$\vec{r}_i = \vec{r}_f - \Delta \vec{r}$$

$$= \langle 400, 350 \rangle - \langle 650, -800 \rangle$$

$$\vec{r}_i = \langle -250, 1150 \rangle \text{ m}$$